DESIGN SUMMARY

LAKE TIPPECANOE
INDIAN CREEK DETENTION BASINS

October 2000

Prepared for:
Tippecanoe Environmental Lake and Watershed Foundation
P.O. Box 55
North Webster, Indiana 46555

Prepared by:
J. F. New & Associates, Inc.
708 Roosevelt Road
Walkerton, Indiana 46574
219-586-3400

DESIGN SUMMARY

LAKE TIPPECANOE
INDIAN CREEK DETENTION BASINS

EXECUTIVE SUMMARY

Two one-half acre stormwater detention basins were constructed at the outlet of drainage tiles that formed the beginning of the Indian Creek drainage on the Tippecanoe Country Club, Leesburg, Indiana. The basins were designed to hold up to a 10 year storm event for a 24 hour period to reduce the amount of phosphorus, nitrogen and bacteria entering the stream and flowing to Lake Tippecanoe. In addition, this detention was also to slow the release rate of storm water to the creek to reduce the rate of erosion of downstream banks and thus decrease the sediment load to the lake. The basins were designed to be dry bottom, maintainable extensions of the existing golf course. As built, the detention basins are permanently saturated, forming a good wetland plant medium. These wet basins are reducing nutrient loading to the lake and reducing the velocity of water entering the creek. The project should be maintained monthly by inspecting and removing leaves and debris from the stone around the perforated PVC outlet structure.

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I. PROJECT DESCRIPTION AND PURPOSE

The project involved the construction of two detention basins on Indian Creek, a tributary of Lake Tippecanoe. The two detention basins were designed to decrease the velocity of the flow through Indian Creek and reduce the phosphorus and fecal coliform bacteria discharge to Lake Tippecanoe. Approximately 60 acres of the Tippecanoe Country Club and another 60 to 100 acres of adjacent agricultural land are drained by an extensive network of tiles which outlet to form the beginning of Indian Creek. These tiles had a combined total diameter of 104 inches. This efficient drainage system delivers water to Indian Creek at a much greater volume and velocity than would otherwise reach the creek through natural overland and ground water flow. These high flow rates to Indian Creek have caused severe erosion and instability of the channel downstream of the tile outlets. In addition, the tiles carry excessive loads of phosphorus, nitrogen, and fecal coliform bacteria. The two detention structures will reduce the water velocity, thereby precipitating phosphorus, reducing fecal coliform bacteria levels and decreasing erosional scouring of the stream bed. All permits necessary for this project are attached as Appendix A and a landowner agreement is attached in Appendix B.

II. DESIGN RATIONALE

Standard engineering calculations were used for sizing the basins, outlet pipe and outlet dam. These engineering calculations are contained in Appendix C along with the soil boring report.

A. Detention Basins

The detention basins were sized to effectively control runoff from a 10-year storm event and release the runoff to Indian Creek over a 24-hour period. The 10-year storm event was chosen as the design flow because these events occur relatively frequently and produce a manageable amount of runoff. The 24-hour time period will eliminate 90% of the fecal coliform, as coliform bacteria generally do not survive more than 24 hours in open water. This design criteria allows the basins to be cost-effectively sized and provide treatment and protection to Indian Creek and Lake Tippecanoe. The computer modeling results for basin design is described in the Feasibility Study, November, 1998.

B. Outlet Structure

The outlet structure consists of two risers, an 8-inch and a 6-inch located within the basin at the low point. The risers are encased in one-inch diameter stone to protect them from damage and provide filtration of the runoff. The 8-inch riser is the main outlet rising vertically from the basin bottom to a height of 2 feet. It is a solid, PVC pipe with an open end protected by a bar screen which keeps solids from entering the pipe. The 6-inch riser is a perforated, PVC pipe also rising to a height of 2 feet. This riser is capped and only allows flow through the 1-inch holes along its length.

The multi-outlet system offers an important advantage over a single-pipe outlet. With a single pipe, storm events less than the 10-year event will not achieve the necessary detention or treatment. However, with the two risers, the water from any storm event will be backed up to the 2 foot level and allowed to slowly filter through the perforations along the 6-inch riser. Additionally, the 8-inch riser provides the necessary outlet for the 10-year storm event. In the event of a larger rainfall, a spillway of large natural stone carries a 100 year event.

C. Energy Dissipaters

Energy dissipaters are used at the pipe outlets to ensure that the flow from the basin outlet pipes do not contribute to the erosional scouring of the creek bed. The dissipaters are constructed of fieldstone and form a ring around the outlet. As the water discharges from the pipe, the dissipaters interrupt the straight-line flow from the pipe. The flow is slowed down and spread out, thus reducing the energy and velocity of the discharge.

D. Emergency Spillway

The emergency spillway is included for protection of the surrounding lands and the integrity of the basin structures. Storm events, such as a 100-year event, cause runoff volumes which can overwhelm man-made structures. The outlet pipes are not sized to handle such large events. During a large storm event, the basins will become completely full and the spillway then becomes the primary outlet for the basin. The spillway directs the excess flow along a path which will control potential erosion and damage to adjacent areas.

III. DESIGN SPECIFICATIONS

A. Basin Earthwork

A copy of the report "Subsurface Investigation & Geotechnical Recommendations" by Alt & Witzig Engineering, Inc. is attached in Appendix C. This report gives recommendations for construction of the basins and contains the soil boring logs. One of the key items within the report is the importance of a stable base for the embankments which will not cause settlement. The report recommends the removal of the soft, top-layer soils to achieve a proper base for compaction which will not cause unacceptable future settling.

Fill material for the detention basins shall contain no more than five percent organic material. Fill shall be free of trash, rubble, or other man-made objects. Fill shall contain no particles larger than four inches, and the plasticity index of the fraction passing the #40 sieve shall not be more than 25%.

Dewatering equipment shall be used to maintain a dry excavation. Dewatering shall lower the water level below the established excavation level before the excavation reaches that level. The dewatering method shall not disturb the density of the sub-grade soils. Dewatering shall be discontinued gradually at a rate not to exceed 25% of the pumping capacity every 3 days or equivalent until all dewatering has ceased.

Sufficient quantities of excavated material suitable for the growth of vegetation shall be preserved from within the excavation area and used for the encasement of all slopes that are to be mulched, seeded or sodded as required.

Embankments and berms shall be constructed true to within 0.1 ft of the lines and grades shown or specified. Embankments and berms shall be constructed using suitable job-excavated material.

B. Erosion Control

Where necessary, a straw bale dike shall be constructed for erosion control. All straw bale dike material shall be removed at the completion of the project. Upon completion of each basin, all disturbed soils will be immediately seeded and covered with straw matting .

C. Clearing and Grubbing

Surface objects, trees, stumps, roots, rocks, and other protruding objects not designated to remain shall be cleared and grubbed. Undisturbed sound stumps, roots, and nonperishable solid objects may be left provided that they are a minimum of four feet below the sub-grade or final grade on slopes and embankments.

Cleared materials shall not be buried on the project site. Materials and debris shall not be disposed of in low lying areas or wetlands. The Country Club has designated a disposal area for stumps. Logs will be hauled off site. Branches and smaller trees will be chipped and spread on site.

D. Pipe Trenching

The pipe trenching shall be as recommended by the manufacturer of the pipe to be installed. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as recommended in the manufacturer's installation manual. The trench width below an elevation one foot above the top of pipe shall not exceed that recommended in the

installation manual. Where no manufacturer's installation manual is available, trench walls below an elevation one foot above the top of pipe shall be vertical and trench walls one foot or more above the top of pipe shall be adequately sloped as required to prevent slides and cave-ins unless proper precautions, as stipulated by OSHA, are taken.

Pipe shall be bedded in compacted Class I or Class II material, placed on a flat trench bottom. The bedding shall have a minimum 4 inch thickness below the pipe and shall extend to 12 inches above the top of the pipe level the full width of the trench. All material shall be placed in the trench in a maximum of six inch layers (before compaction). Each layer, shall be leveled and evenly distributed on both sides of the pipe so as not to disturb, displace or damage the pipe and shall be adequately compacted. When Class I materials are used compaction may be accomplished by hand or mechanical tamping or by "walking" the material in. When Class II materials are used compaction shall be accomplished only by hand or mechanical tamping.

Class I materials shall meet the following requirements: angular, ¼ inch to 1-1/2 inches, graded stone such as crushed stone.

Class II materials shall meet the following requirements: coarse sands and gravel with maximum particle size of 1-1/2 inches, including various grades of sands and gravel containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

IV. CONSTRUCTION SCHEDULE

The project was scheduled to begin the first working day in January 1999. The project began on that day and was completed in May of 1999 with the installation of plant plugs in the basins.

Tasks	**Date of Construction**
1) Remove trees from designated work area	Jan 1- Jan 10, 1999
2) Excavate basins to size shown on plans	Jan 10 - Feb 10, 1999
3) Replace 24 inch culvert from junction box	Feb 10-15, 1999
4) Install dams with outlet structures/rock armor	Feb 15-28, 1999
5) Install seed and erosion control cloth in basins	March 1-30, 1999
6) Repair construction access and use spoils for constructing contours on fairways, seed.	April 1-30, 1999
7) Plant shrubs and wetland plants in basins	May 1-30, 1999

V. MAINTENANCE ACTIVITIES

The primary maintenance activity will be inspections of the outlet structures by the landowner each month and after each rain event. The outlet pipes and energy dissipaters should be clear of leaves and other debris. Accumulated debris should be removed to allow unimpeded flow out of the detention basins. Maintaining these areas clear of debris will also prevent this material from flowing into the lake.

Although the detention basins were designed to be dry bottom, ground water saturates the basins forming permanent wetlands. The basins were planted with native aquatic vegetation which should flourish without maintenance. The basins should be cleaned of sediment and organic matter only if they become completely choked with plants such that risers are getting plugged after every precipitation event or if the bottom of the natural flow path exceeds the height of the lower riser. The detention basin dams should be inspected monthly for evidence of damage from erosion or burrowing animals. Any damage should be repaired immediately. Repair will consist of backfilling any holes or eroded areas with available then seeding and covering with straw mulch. Attached as Appendix C is an inspection form for construction and maintenance.

VI. PROJECT CONCLUSIONS

The two designed and constructed retention basins are functioning to hold water and release it slowly downstream. The basins are supporting a good population of wetland plants that will soon dominate the otherwise one-three inch deep open water in the center of the basins as well as the remainder of the basins which are saturated permanently. The basins have held up well under several 10 year storm event after construction. Monthly inspection and cleaning of the outlet risers is a necessity due to the number of leaves that clog the gravel filter as it flows into the six inch riser. It is expected that these structures will continue to work as designed and provide benefits to the lake for many years into the future.

MAINTENANCE INSPECTION FORM

Project Name: Indian Creek Detention Basins

Date: _____

Weather Conditions: _____

1. Is the Inlet Structure clear of debris? If not, remove all accumulated debris from the structure.

2. Is the Outlet Structure clear of debris? If not, remove all accumulated debris from the structure.

3. (a) Is the Energy Dissipater in its original configuration?

(b) Is the Energy Dissipater functioning as proposed?

4. Is there evidence of erosion on the side slopes of the dam?

5. Is the detention basin completely vegetated? Please provide recommendations for vegetating bare areas.

6. Is there any bank erosion occurring downstream of the structure?

7. Other observations.

Inspector Signature and Printed Name: _____

Mail completed form to: **Tippecanoe Environmental Lake and Watershed Foundation**
P.O. Box 55
North Webster, Indiana 46555

APPENDIX A

PERMITS

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
P.O. BOX 59
LOUISVILLE, KENTUCKY 40201-0059

November 25, 1998

Operations Division
Regulatory Branch (North)
ID No. 199801139-asb

Blaire Clark
Tippecanoe Country Club
7245 North Kolarama Road
Leesburg, Indiana 46358

Dear Ms. Clark:

This is in response to your request for authorization to construct dams across two small drainages associated with Indian Creek in Kosciusko County, Indiana, for stormwater and sediment detention. The information supplied by you was reviewed to determine whether a Department of the Army (DA) permit will be required under the provisions of Section 404 of the Clean Water Act.

Your project is considered a discharge of fill material into a headwaters or isolated waters. Since less than 3 acres of "waters of the United States" would be impacted by this discharge and the work site is above the headwaters of Indian Creek, the project is authorized under the provisions of Nationwide General Permit 33 CFR 330 (26), Headwaters and Isolated Waters Discharges, as published in the Federal Register, December 13, 1996. Under the provisions of this authorization you must comply with the enclosed Terms for Nationwide Permit No. 26 and the Nationwide Permit Conditions.

Additionally, you must also obtain individual Water Quality Certification (WQC) from the Indiana Department of Environmental Management (IDEM) **prior** to commencement of the proposed activity. Please furnish a copy of your requesting letter to us.

You can write to IDEM at:

Indiana Department of Environmental Management
P.O. Box 6015
Indianapolis, Indiana 46206-6015
Telephone: (317) 232-8683

If we do not hear from IDEM within 60 days of the receipt of your letter, we will presume a waiver of the WQC. We may grant IDEM additional time if requested. The responsibility for obtaining the state WQC rests with you.

After you obtain your certification or waiver, you may proceed with construction without further contact or verification from us. However, a copy of the WQC must be forwarded to us. Please note that you must comply with any WQC conditions.

The enclosed Compliance Certification should be signed and returned when the project is completed. This verification is valid until Nationwide Permit (NWP) 26 expires or for 2 years, whichever comes first. Currently NWP 26 expires on September 15, 1999. If your project is not completed by that date or if your project is modified, you must contact us for another permit determination. A copy of this letter is being sent to your agent and to the IDEM.

If you have any questions, please contact me by writing to the above address, ATTN: CELRL-OP-FN, or by calling (502) 582-5607. Any correspondence on this matter should refer to our ID No. 199801139-asb.

Sincerely,

SIGNATURE SIGNED

Amy S. Babey
Project Manager
Regulatory Branch

Enclosure

ADDRESS FOR AUTHORIZED AGENT

John B. Richardson
J.F. New & Associates, Inc.
708 Roosevelt Road
P.O. Box 243
Walkerton, Indiana 46574

TERMS FOR NATIONWIDE PERMIT NO. 26

Headwaters and Isolated Waters Discharges. Discharges of dredged or fill material into headwaters and isolated waters provided that the activity meets all of the following criteria:

a. The discharge does not cause the loss of more than 3 acres of waters of the United States nor cause the loss of waters of the United States for a distance greater than 500 linear feet of the stream bed;
b. For discharges causing the loss of greater than 1/3 acre of waters of the United States, the permittee notifies the District Engineer in accordance with the "Notification" general condition;
c. For discharges causing a loss of 1/3 acre or less of waters of the United States the permittee must submit a report within 30 days of completion of the work, containing the information listed below;
d. For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands (Also see 33 CFR 330.1(e)); and
e. The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. Note, this NWP will expire on December 13, 1998.

For the purposes of this NWP, the acreage of loss of waters of the United States includes the filled area plus waters of the United States that are adversely affected by flooding, excavation or drainage as a result of the project. The 3 acre and 1/3 acre limits of NWP 26 are absolute, and cannot be increased by any mitigation plan offered by the applicant or required by the District Engineer. Whenever any other NWP is used in conjunction with this NWP, the total acreage of impacts to waters of the United States of all NWPs combined, can not exceed 3 acres.

Subdivisions: For any real estate subdivision created or subdivided after October 5, 1984, a notification pursuant to subsection (b) of this NWP is required for any discharge which would cause the aggregate total loss of waters of the United States for the entire subdivision to exceed 1/3 acre. Any discharge in any real estate subdivision which would cause the aggregate total loss of waters of the United States in the subdivision to exceed 3 acres is not authorized by this NWP; unless the District Engineer exempts a particular subdivision or parcel by making a written determination that: (1) the individual and cumulative adverse environmental effects would be minimal and the property owner had, after October 5, 1984, but prior to February 11, 1997, committed substantial resources in reliance on NWP 26 with regard to a subdivision, in circumstances where it would be inequitable to frustrate the property owner s investment-backed expectations, or (2) that the individual and cumulative adverse environmental effects would be minimal, high quality wetlands would not be adversely affected, and there would be an overall benefit to the aquatic environment. Once the exemption is established for a subdivision, subsequent lot development by individual property owners may proceed using NWP 26. For purposes of NWP 26, the term "real estate subdivision" shall be interpreted to include circumstances where a landowner or developer divides a tract of land into smaller parcels for the purpose of selling, conveying, transferring, leasing, or developing said parcels. This would include the entire area of a residential, commercial or other real estate subdivision, including all parcels and parts thereof.

Report: For discharges causing the loss of 1/3 acre or less of waters of the United States the permittee must submit a report within 30 days of completion of the work, containing the following information:

a. Name, address, and telephone number of the permittee;
b. Location of the work;
c. Description of the work; and,
d. Type and acreage (or square feet) of the loss of waters of the United States (e.g., 1/10 acre of marsh and 50 Square feet of a stream.) (Section 404)

NATIONWIDE PERMIT CONDITIONS

GENERAL CONDITIONS:

The following general conditions must be followed in order for any authorization by a NWP to be valid:

1. Navigation. No activity may cause more than a minimal adverse effect on navigation.

2. Proper maintenance. Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.

3. Erosion and siltation controls. Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.

4. Aquatic life movements. No activity may substantially disrupt the movement of those species of aquatic life indigenous to the water body, including those species which normally migrate through the area, unless the activity s primary purpose is to impound water.

5. Equipment. Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

6. Regional and case-by-case conditions. The activity must comply with any regional conditions which may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its section 401 water quality certification.

7. Wild and Scenic Rivers. No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service.)

8. Tribal rights. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. Water quality certification. In certain states, an individual Section 401 water quality certification must be obtained or waived (see 33 CFR 330.4(c)).

10. Endangered Species.

a. No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or critical habitat might be affected or is in the vicinity of the project, and shall not begin work on the activity until notified by the District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized.

b. Authorization of an activity by a nationwide permit does not authorize the take of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with incidental take provisions, etc.) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal takes of protected species are in violation of the Endangered Species Act. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. Fish and Wildlife Service and National Marine Fisheries Service or their world wide web pages at http://www.fws.gov/~r9endspp/endspp.html and http://kingfish.spp.mnfs.gov/tmcintyr/prot_res.html#ES and Recovery, respectively.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We make Indiana a cleaner, healthier place to live

Frank O'Bannon
Governor

John M. Hamilton
Commissioner

100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015
(317) 232-8603
(800) 451-6027
www.ai.org/idem

November 5, 1998

VIA CERTIFIED MAIL P 126 014 995

Mr. Blair Clark
Tippecanoe Country Club
7245 N. Kolarama Road
Leesburg, IN 46358

Dear Mr. Clark:

Re: Section 401 Water Quality Certification
Project: TELWF- Indian Creek
IDEM ID #: 98-43-RRJ-00395-A
COE ID #: 199801139-asb
County: Kosciusko

Office of Water Management staff have reviewed your application dated September 25, 1998, requesting Section 401 Water Quality Certification. You propose to construct two stormwater detention basins in intermittent drainageways to slow stormwater rates to reduce erosion and minimize sediment entering Tippecanoe Lake. Approximately 0.2 acres of the waterways will be filled for dam construction. Approximately 400 linear feet of waterways will be affected by the project. No wetlands will be affected by the project.

Based on the site inspection conducted on April 6, 1998, and available information, it is the judgment of this office that the proposed project will comply with the applicable provisions of 327 IAC 2 and Sections 301, 302, 303, 306, and 307 of the Clean Water Act if the applicant complies with the conditions set forth below. Therefore, subject to the following conditions, the Indiana Department of Environmental Management (IDEM) hereby grants Section 401 Water Quality Certification for the project described in your application dated September 24, 1998. Any changes in project design or scope not detailed in the application described above are not authorized by this certification.

General Conditions:

1. Physical disturbance of banks, soils, and vegetation shall be limited to that which is absolutely necessary to achieve the project purpose.

2. Reseed all bare and disturbed areas with a mixture of grasses (excluding all varieties of tall fescue) and legumes upon completion.

3. The contractor performing the actual operations must comply with Section 311 of

and Procedures Act. The steps that must be followed to qualify for review are:

1. You must petition for review in a writing that states facts demonstrating that you are either the person to whom this decision is directed, a person who is aggrieved or adversely affected by the decision, or a person entitled to review under any law.

2. You must file the petition for review with the Office of Environmental Adjudication (OEA) at the following address:

   Office of Environmental Adjudication
   ISTA Building
   150 West Market Street
   Suite 618
   Indianapolis, IN 46204

3. You must file the petition within eighteen (18) days of the mailing date of this decision. If the eighteenth day falls on a Saturday, Sunday, legal holiday, or other day that the OEA offices are closed during regular business hours, you may file the petition the next day that the OEA offices are open during regular business hours. The petition is deemed filed on the earliest of the following dates: the date it is personally delivered to OEA; the date that the envelope containing the petition is postmarked if it is mailed by United States mail; or, the date it is shown to have been deposited with a private carrier on the private carrier's receipt, if sent by private carrier.

Identifying the permit, decision, or other order for which you seek review by permit number, name of the applicant, location, or date of this notice will expedite review of the petition.

Note that if a petition for review is granted pursuant to IC 4-21.5-3-7, the petitioner will, and any other person may, obtain notice of any prehearing conferences, preliminary hearings, hearings, stays, and any orders disposing of the proceedings by requesting copies of such notices from OEA.

Granting of Section 401 Water Quality Certification does not relieve the applicant from the responsibility of obtaining any other permits or authorizations that may be required for this project or related activities from IDEM or any other agency or person.

This certification does not:

(1) authorize impacts or activities not detailed in the application or Corps Public Notice;

(2) authorize any injury to persons or private property or invasion of other private rights, or any infringement of federal, state or local laws or regulations;

(3) convey any property rights of any sort, or any exclusive priveleges;

(4) preempt any duty to obtain federal, state or local permits or authorizations

APPENDIX B

LANDOWNER AGREEMENT

Agreement For Construction and Maintenance of Storm Water Detention Basins, Dry

This agreement, made and entered into on this 28 day of September, 1998, by and between Tippecanoe Lake Country Club, (hereinafter referred to as LESSOR), and the Tippecanoe Environmental Lake and Watershed Foundation, a not-for-profit corporation organized under the laws of the State of Indiana, (hereinafter referred to as LESSEE),

WITNESSETH:

Lessor, in consideration of the rents and covenants herein contained, does hereby lease to Lessee approximately .726 acres of land located in Tippecanoe Township, Kosciusko County, Indiana, in the Southwest Fractional Quarter of Section 6-T33N-R7E and more particularly described in the legal descriptions attached as Exhibit "A" (hereinafter often referred to as the "Property") and does hereby grant to Lessee access to said acreage for the construction of certain storm water detention basins, dry.

WHEREAS, the Tippecanoe Environmental Lake and Watershed Foundation is a not-for-profit Indiana corporation which is dedicated to improving the water quality of Tippecanoe Lake, located in Kosciusko County, Indiana and

WHEREAS, the Tippecanoe Environmental Lake and Watershed Foundation, wishes to undertake activities and construction on the Property as part of its Lake Enhancement project to improve the water quality of Tippecanoe Lake, located in Kosciusko County, Indiana, and

WHEREAS, Lessor is in agreement with the Tippecanoe Environmental Lake and Watershed Foundation's desire to improve the water quality of Tippecanoe Lake.

NOW, THEREFORE, Lessor, for themselves, their assigns, and administrators, in consideration of the covenants, undertakings and agreements hereinafter set forth, and in consideration of the sum of Ten Dollars ($10.00) and other valuable consideration, the receipt of which is hereby acknowledged, hereby leases to Lessee the Property described herein under the following terms and conditions:

1. TERM. This lease shall commence on the first day of construction on the Property and continue for a term of ninety-nine (99) years from the date of the signing of this lease. If construction

is not begun by January 4, 1999, this contract is null and void.

2. RENT. Lessee shall pay to Lessor the sum of Ten Dollars and No Cents ($10.00) at the time of signing the lease. It is agreed that the Lessee is not responsible for any further payments of rent during the duration of the lease.

3. USE/MANAGEMENT.

A. Lessor grants to lessee the right to do specific acts of the Property as set out herein and Lessor retains all other rights to the Property that do not infringe on or impede the rights granted to Lessee.

B. Lessor grants Lessee the right to construct a storm water detention basin, dry on the Property as defined on the engineering drawings for project 98-25. The detention area will function as a sedimentation basin and as an area for the removal of nutrients. Lessor agrees to Lessee's right to plant vegetation on the Property and to maintain control of the design elevation of the wetland. This paragraph B represents the Intended Use of the Property by the Lessee. The purpose of the Intended Use and construction as set out herein in more fully described in the Section 8 of the Design Report for the Tippecanoe Environment Lake and Watershed Foundation project 98-25, which is incorporated herein by reference.

C. Lessor grants to Lessee a fifteen (15) foot wide access easement as described herein:

> Access via the existing maintenance road along the north side of #12 fairway of the Lessor's golf course which maintenance road also runs in front of #12 tee station, continuing on the cartpath on the north side of the men's low level #8 tee station towards a westerly corner prior to #7 green in which the access easement shall turn southerly and run behind the ladies' #2 tee towards the Property.

Lessor grants to Lessee the right of ingress and egress to and from the Property from the access easement as well as reasonable access on, over, and along the said access easement for the purpose of the construction, inspection, maintenance and repair of the structures and vegetation on the Property. Lessor, for themselves, their heirs, assigns and administrators agree that they will do no construction or building on the access easement during the term of construction or without providing Lessee with an alternative access path to the Property. Lessee agrees to repair any construction or maintenance damage and to restore site to a condition equivalent to original conditions as determined

by photographs taken prior to construction.

D. Lessor agrees that Lessee and its agents shall be permitted to enter onto the Property with such machinery, materials and equipment and the personnel and workers to operate said machinery and equipment to carry out the Intended Use of the Property by Lessee, including, but not limited to, the construction, inspection of, maintenance and repair of the earthen berm and basins and the planting of vegetation. It is agreed that all improvements shall stay with the land.

E. Lessor agrees and its agents shall have the right to take such tests and borings on the Property as Lessee deems necessary to carry out its intended Use, and to take photographs of the Property.

F. Lessor limits the rights granted to Lessee as follows: Lessee may enter onto the Property only for activities directly related to the Intended Use of the Property and not for the recreational use by Lessee and its agents.

G. Rights to the Property shall be retained by Lessor as long as those activities do not interfere with or jeopardize the Intended Use of the Property by Lessee. In addition, Lessor agrees to refrain from altering the detention basin areas from that set out in the design defined in the Engineering Drawings for project 98-25.

H. Lessee shall have use of Lessor's disposal area for equipment storage and for disposal of trees and shrubs. Lessor shall have use of the soil removed from the Property by Lessee.

I. Lessee shall give notice to Lessor of its intention to enter onto the Property for purposes of inspection, maintenance and repair of the structures, detention basins, and vegetation of the Property. Lessee shall not enter Property without permission from Lessor, which permission will not be unreasonably withheld.

J. Upon completion of the detention basins, dry, Lessor will control use of the detention basin area. Lessor will manage and control plant and animal life on the Property. Lessor will provide all maintenance required on the Property as necessary to achieve and sustain the Intended Use of the Property as defined in section 3.B. of this lease.

K. Lessee will introduce only plant life into the Property.

4. TAXES. Lessor shall pay all real property taxes and assessments due on the Property during the term of the lease.

5. CONDEMNATION. Lessor agrees that if the Property, or any part thereof, shall be taken or condemned for public or quasi-public use or purpose by any competent authority, Lessee shall have the right to defend against such attempted condemnation of the Property or any part thereof. If, in the opinion of Lessee, the Property becomes unmanageable or unsuitable for its Intended Use and Purpose as a result of such condemnation, this lease may be terminated by Lessee upon sixty (60) days written notice to Lessor.

6. LIABILITY/INSURANCE.

A. Nothing in this lease shall be construed as imposing any additional liability on Lessor. Lessee shall name the Lessor as additional insured on Lessee's liability policy. Prior to the start of construction and throughout the term of the lease thereafter, Lessee shall carry a policy of public liability insurance covering all of its activities on the Property. At the request of Lessor, Lessee shall provide Lessor with a certificate or other evidence that such insurance is in effect.

B. Lessee shall be responsible for and shall indemnify and hold Lessor harmless from any and all costs, including but not limited to the expense of defending any claim of legal action. related to any injury or damage to Lessee, Lessor or any other party or caused by or resulting from Lessee's activities on the Property.

C. Lessee shall be responsible for all damages as a result of a failure of any earthen dams used in the construction of the detention basins unless such failure is a result of actions of the Lessor.

7. SUB-LEASE/ASSIGNMENT. Lessee may not assign this lease or sublet all or any portion of the Property without the prior written consent of Lessor.

8. DAMAGES.

A. Lessee shall restore all road surfaces owned by Lessor to its original condition if said surfaces are damaged by equipment and/or machinery used by Lessee and its agents during ingress and egress from the Property.

B. Before final completion of the work on said premises, Lessee and its agents shall adequately clean up the construction site to the complete satisfaction of Lessor.

C. This commitment pertains to construction, repair and maintenance done by Lessee and its agents on the Property.

9. EXPENSE. Lessee shall be responsible for all expenses incurred in the construction, repair, use, inspection and maintenance of the Intended Use of the Property by Lessee as set out in section 3 of this lease.

10. NO LIEN AGREEMENT. In consideration of the rents and covenants herein contained, Lessee, for itself and for all contractors, subcontractors, laborers, or persons performing labor upon or furnishing materials or machinery for the Intended Use of the Property as set out herein, agrees that:

A. No lien shall attach to the Property or to Lessor's property, or to any structure or other improvement to be construed on the Property; and

B. Any recording of this Agreement is intended solely for the purpose of giving proper notice as provided under IC 32-8-3-1 et seq.; and no lien whatsoever is created against the real estate as the result of the execution or recordation of this Agreement.

11 TRESPASS. Lessor grants to Lessee and its agents permission to enter onto the Property at any time to carry out its Intended Use as set out herein. All others shall be considered trespassers on the Property unless the party has the permission of Lessor and Lessee to be on the Property.

12. DEFAULT.

A. Breach of any covenant contained herein shall constitute a default under this lease. In the event of a default, the defaulting party shall be entitled to thirty (30) days written notice specifying the nature of the default and giving the defaulting party an opportunity to cure the default. If the default is not corrected within thirty (30) days after notice is received, the injured party may elect to terminate this lease.

B. If the use intended for the Property is not approved by any governmental agency having jurisdiction over the construction and maintenance of storm water detention basins, dry, Lessee and Lessor shall each have the right to terminate the lease by giving written notice to the other party. Within sixty (60) days from the date the notice is received by Lessor, the lease shall be null and void.

C. If the construction for the Intended Use as set out in section 3 of this lease is not completed by March 31, 1999 from the date construction is begun, then Lessor has the right to give written notice to Lessee to terminate the lease and Lessee shall have fifteen (15) days in which to

complete the project as set out in section 3 of this lease. If the construction for the Intended Use is not accomplished within said fifteen (15) day period from the date the notice is received by Lessee, the lease shall be null and void. Provided, however, that if Lessee's delay in construction is due to environmental factors out of its control (such as weather conditions), Lessee shall have thirty (30) days in which to complete the project as set out in section 3 of this lease agreement.

13. NOTICE. Any notice required by this lease shall be served upon the other party by mail at the address set forth below or at such other addresses as the parties may hereafter designate:

Tippecanoe Lake Country Club
7245 N. Kalorama Road
Leesburg, Indiana 46538

Tippecanoe Environmental Lake and Watershed Foundation
Post Office Box 55
North Webster, Indiana 46555

or to the acting president of said association at the address provided by Lessee to Lessor.

14. AGENTS. Where in this instrument rights are given to either the Tippecanoe Environmental Lake and Watershed Foundation or Lessors, such rights shall also extend to the agents or employees of the parties.

15. BINDING EFFECT. This lease shall become effective at the time construction on the Property begins and shall be binding upon Lessor, their heirs, personal representatives, successors and assigns and upon Lessee and Lessee's successor organizations.

16. TITLE. Lessor hereby represents and warrants that they are owners of the Property covered by this lease and that they have the right to enter into this lease and to bind themselves and their heirs, successors, assigns, and personal representatives.

17. This lease shall be interpreted under the laws of the State of Indiana.

18. Headings are for reference only and do not affect the provisions of this lease agreement.

19. Where appropriate, the singular shall include the plural.

20. This lease agreement contains all of the agreements of the parties, all prior negotiations, understandings and agreements having been merged into it. Amendments of this lease agreement

shall not be effective unless made in writing and signed by the parties.

21. In computing a time period prescribed in this lease agreement, the day of the act or event shall not be counted. All subsequent days, including intervening weekend days and holidays, shall be counted in the period.

22. In the event the Tippecanoe Environmental Lake and Watershed Foundation should cease to exist, the lease shall be binding upon the organization that succeeds the said association, provided that the succeeding organization's membership consists of property owners of real estate on Tippecanoe Lake, Kosciusko County, Indiana.

23. This Agreement shall be recorded in the Office of the Recorder of Kosciusko County, Indiana. The Lessee shall pay the recording fee.

24. Any person signing this Agreement in a representative capacity for a party affirms under the penalties for perjury that he or she has the actual authority to so sign.

IN WITNESS WHEREOF, Lessor, Tippecanoe Lake Country Club, and Lessee, Tippecanoe Environmental Lake and Watershed Foundation, by their agents, have caused this Agreement to be executed on the day and year above first written with the following signatures.

TIPPECANOE LAKE COUNTRY CLUB

BY: _____
Terry D. Schlotterback, President

ATTEST: _____

LESSOR

TIPPECANOE ENVIRONMENTAL LAKE AND WATERSHED FOUNDATION

BY: _____

PRESIDENT

_____

MEMBER, BOARD OF DIRECTORS

LESSEE

STATE OF INDIANA)
) SS:
COUNTY OF WHITLEY)

Before me, a Notary Public in and for said County and State, on the 28 day of September, personally appeared Terry D. Schlotterback and Clayton R. Krecker, and each acknowledged the execution of the above and foregoing Agreement to his voluntary act and deed.

WITNESS my hand and Notarial Seal.

Amy Sutter
Notary Public
Resident of Kosciusko County, Indiana

My Commission Expires:
Jan. 12, 00

STATE OF INDIANA)
) SS:
COUNTY OF ~~WHITLEY~~ KOSCIUSKO)

Before me, a Notary Public in and for said County and State, personally appeared Robert E. Smith and Holly LaSalle, president and member of Board of Directors, respectively, of Tippecanoe Environmental Lake and Watershed Foundation, who, having been duly sworn, acknowledged the execution of the above and foregoing Agreement as officer and a member of the board of directors for and on behalf of said Tippecanoe Environmental Lake and Watershed Foundation and by authority of its board of directors this 29th day of September, 1998.

WITNESS my hand and Notarial Seal.

Lindsey Argerbright
Lindsey Argerbright Notary Public
Resident of Kosciusko County, Indiana

My Commission Expires:
4-18-2008

This instrument prepared by: Marcia A. McNagny, Supreme Court ID # 15788-92, MYERS HOCKEMEYER & McNAGNY, 202 W Van Buren Street, Suite A, Columbia City, Indiana 46725. Telephone: (219) 248-2224.

LEGAL DESCRIPTION
TRACT "A"

A PART OF LOT NUMBER TWO HUNDRED FIFTY-ONE (#251) AS THE SAID LOT IS KNOWN AND DESIGNATED ON THE PLAT OF RAVINA PARK; SAID PLAT BEING RECORDED IN THE OFFICE OF THE RECORDER OF KOSCIUSKO COUNTY IN PLAT BOOK 3, PAGE 289, ALSO A PART OF THE SOUTHWEST QUARTER OF SECTION 6, TOWNSHIP 33 NORTH, RANGE 7 EAST, TIPPECANOE TOWNSHIP, KOSCIUSKO COUNTY, INDIANA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF SAID LOT #251; THENCE SOUTHWESTERLY ALONG THE SOUTHERLY LINE OF SAID LOT #251, BEING ON THE ARC OF A 140.00 FOOT RADIUS CURVE TO THE LEFT, CONCAVE TO THE SOUTHEAST, A DISTANCE OF 108.75 FEET (CHORD BEARING SOUTH 62 DEGREES 02 MINUTES 47 SECONDS WEST, CHORD DISTANCE 106.03 FEET); THENCE NORTH 01 DEGREE 26 MINUTES 31 SECONDS WEST, A DISTANCE OF 207.55 FEET; THENCE SOUTH 83 DEGREES 05 MINUTES 27 SECONDS EAST, A DISTANCE OF 84.86 FEET TO THE NORTHERLY EXTENSION OF THE EASTERLY LINE OF SAID LOT #251; THENCE SOUTH 05 DEGREES 39 MINUTES 52 SECONDS EAST ALONG THE EASTERLY LINE OF SAID LOT #251 AND THE EXTENSION THEREOF, A DISTANCE OF 148.29 FEET TO THE POINT OF BEGINNING OF THIS DESCRIPTION CONTAINING 0.35 OF AN ACRE, MORE OR LESS, BEING SUBJECT TO ALL EASEMENTS, RESTRICTIONS AND PUBLIC RIGHTS OF WAY OF RECORD.

DATE: AUGUST 17, 1998
JOB#: 98-25
DRW#: A98-19

BRADS-KO ENGINEERING & SURVEYING, INC.

GREGORY C. SHOCK R.L.S. #S0484

GREGORY C. SHOCK
REGISTERED
No. S 0484
STATE OF
INDIANA
LAND SURVEYOR

LEGAL DESCRIPTION
TRACT "B"

LOT NUMBER TWO HUNDRED FORTY-SIX (#246), LOT NUMBER TWO HUNDRED FORTY-SEVEN (#247) AND A PART OF LOT NUMBER TWO HUNDRED FORTY-EIGHT (#248) AS THE SAID LOTS ARE KNOWN AND DESIGNATED ON THE PLAT OF RAVINA PARK; SAID PLAT BEING RECORDED IN THE OFFICE OF THE RECORDER OF KOSCIUSKO COUNTY IN PLAT BOOK 3, PAGE 289, ALSO A PART OF THE SOUTHWEST QUARTER OF SECTION 6, TOWNSHIP 33 NORTH, RANGE 7 EAST, TIPPECANOE TOWNSHIP, KOSCIUSKO COUNTY, INDIANA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF SAID LOT #246; THENCE SOUTH 84 DEGREES 20 MINUTES 08 SECONDS WEST ALONG THE SOUTH LINE OF SAID LOT #246, LOT #247 AND A PART OF LOT #248, A DISTANCE OF 123.11 FEET; THENCE NORTH 05 DEGREES 39 MINUTES 52 SECONDS WEST, A DISTANCE OF 144.00 FEET; THENCE SOUTH 85 DEGREES 31 MINUTES 57 SECONDS EAST, A DISTANCE OF 125.06 FEET TO THE NORTHERLY EXTENSION OF THE EASTERLY LINE OF SAID LOT #246; THENCE SOUTH 05 DEGREES 39 MINUTES 52 SECONDS EAST ALONG THE EASTERLY LINE OF SAID LOT #246 AND THE EXTENSION THEREOF, A DISTANCE OF 122.00 FEET TO THE POINT OF BEGINNING OF THIS DESCRIPTION CONTAINING 0.376 OF AN ACRE, MORE OR LESS, BEING SUBJECT TO ALL EASEMENTS, RESTRICTIONS AND PUBLIC RIGHTS OF WAY OF RECORD.

DATE: AUGUST 17, 1998
JOB#: 98-25
DRW#: A98-19

BRADS-KO ENGINEERING & SURVEYING, INC.

GREGORY C. SHOCK R.L.S. #S0484

GREGORY C. SHOCK
REGISTERED
No. S 0484
STATE OF
INDIANA
LAND SURVEYOR

APPENDIX C

ENGINEERING CALCULATIONS

and

SOIL BORING REPORT

INDIAN CREEK DESIGN CALCULATIONS

1. Discharge

The 10-yr hydrograph was used to determine a peak flow of 23.5 cfs to each basin (assuming each basin gets ½ of the rainfall). A peak outflow of 7.5 cfs provides a storage volume of 0.88 ac-ft. The outlet pipe was sized to provide the necessary 7.5 cfs under 2.5 ft of head. Both west and east ponds require a 10" diameter pipe. At normal conditions, assuming 0.5 ft head, the outflow will be around 3 cfs. See worksheets for more details.

2. Spillway Dimensions

$$q = CLH^{3/2}$$

q = Discharge (cfs)
C = Coefficient
L = Length (ft)
H = Head (ft)

The equation was rearranged to solve for the length of the spillway necessary. Discharge was calculated assumming 5 ft of head to provide a conservative estimate.

$$L = \frac{q}{CH^{3/2}}$$

$$L = \frac{12.19\ cfs}{3.2*1} = 3.81\ ft \qquad West\ Pond$$

$$L = \frac{11.04\ cfs}{3.2*1} = 3.45\ ft \qquad East\ Pond$$

The length of the spillway must be at least the length indicated above to allow the maximum discharge through. I made the spillway 10 ft long.

The maximum water surface elevation was assumed to be 898. I placed the bottom of the spillway at 897.5 and placed 6" of 6" rip rap along the spillway providing a top of rip rap elevation at 898. Top of berm will be at 899, providing 1 foot of freeboard.

POND-2 Version: 5.17 S/N:

>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

Inflow Hydrograph: 10 .HYD
Qpeak = 47.0 cfs

Estimated Outflow: ESTIMATE.EST
Qpeak = 30.0 cfs

use Flowmaster & Sizg

Approximate Storage Volume
(computed from t= 12.00 to 12.75 hrs)

0.8 acre-ft

Available storage is 0.7 ac-ft

INDIAN CREEK - STORAGE DETERMINATION
6/15/98

POND-2 Version: 5.17 S/N:

>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

Inflow Hydrograph: 100 .HYD
Qpeak = 197.0 cfs

Estimated Outflow: ESTIMATE.EST
Qpeak = 190.0 cfs

Approximate Storage Volume
(computed from t= 12.10 to 12.51 hrs)

0.7 acre-ft available storage

POND-2 Version: 5.17
S/N:

Flint Lake - East Pond

CALCULATED 06-15-1998 09:18:09
DISK FILE: BRAD .VOL

Planimeter scale: 1 inch = 208.7133 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
893.00	0.04	0.04	0.00	0.00	0.00
894.00	*I*	0.05	0.14	0.05	0.05
895.00	*I*	0.07	0.16	0.11	0.11
896.00	*I*	0.09	0.19	0.19	0.19
897.00	0.12	0.12	0.22	0.30	0.30

I ---> Interpolated area from closest two planimeter readings.

* Incremental volume computed by the Conic Method for Reservoir Volumes.

E+W Pond Total Storage = 0.70 ac-ft

POND-2 Version: 5.17
S/N:

Flint Lake - West Pond

CALCULATED 06-15-1998 09:16:10
DISK FILE: BRAD .VOL

Planimeter scale: 1 inch = 208.7133 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
893.00	0.06	0.06	0.00	0.00	0.00
894.00	*I*	0.08	0.22	0.07	0.07
895.00	*I*	0.10	0.24	0.16	0.16
896.00	*I*	0.12	0.27	0.27	0.27
897.00	0.14	0.14	0.30	0.40	0.40

I ---> Interpolated area from closest two planimeter readings.

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Basin Sizing

FILE VERSION: 1.0

PROJECT NAME: Lake Tippe - West
STRUCTURE: Basin
FILE NAME: SEDIMENT.WK4
FILE DATE: 11-Feb-98

Width at Top of Basin:	70	ft
Length at Top of Basin:	150	ft
Slope Ratio:	3	w/d
Depth of Basin:	5	ft
Width at Bottom of Basin:	40	ft
Length at Bottom of Basin:	120	ft
Volume to 100% of Basin:	0.88	ac-ft

BASIN SIZING

FILE VERSION: 1.0

PROJECT NAME: Lake Tippe - East
STRUCTURE: Basin

FILE NAME: SEDIMENT.WK4
FILE DATE: 11-Feb-98

Width at Top of Basin:	80	ft
Length at Top of Basin:	125	ft
Slope Ratio:	3	w/d
Depth of Basin:	5	ft
Width at Bottom of Basin:	50	ft
Length at Bottom of Basin:	95	ft
Volume to 100% of Basin:	0.85	ac-ft

POND-2 Version: 5.17 S/N:

>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

Inflow Hydrograph: 787 .HYD
Qpeak = 23.5 cfs

Estimated Outflow: ESTIMATE.EST
Qpeak = [redacted]

Approximate Storage Volume
(computed from t= 12.00 to 13.15 hrs)

0.9 acre-ft

WEST

Worksheet
Worksheet for Pressure Pipe

Project Description	
Project File	c:\fmw\tip.fm2
Worksheet	tip
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.00 lbs/in²
Pressure at 2	0.00 lbs/in²
Elevation at 1	2.50 ft
Elevation at 2	0.00 ft
Length	40.00 ft
C Coefficient	140.0
Diameter	10.00 in

Results		
Discharge	8.38	cfs
Headloss	2.50	ft
Energy Grade at 1	3.15	ft
Energy Grade at 2	0.65	ft
Hydraulic Grade at 1	2.50	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.62	ft
Velocity	15.37	ft/s
Velocity Head	3.67	ft
Friction Slope	0.062500	ft/ft

WEST

Worksheet
Worksheet for Pressure Pipe

Project Description	
Project File	c:\fmw\tip.fm2
Worksheet	tip
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.00 lbe/in²
Pressure at 2	0.00 lbe/in²
Elevation at 1	5.00 ft
Elevation at 2	0.00 ft
Length	40.00 ft
C Coefficient	140.0
Diameter	10.00 in

Results		
Discharge	12.19	cfs
Headloss	5.00	ft
Energy Grade at 1	8.67	ft
Energy Grade at 2	3.67	ft
Hydraulic Grade at 1	5.00	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.62	ft
Velocity	22.35	ft/s
Velocity Head	7.76	ft
Friction Slope	0.125000	ft/ft

WEST

Worksheet
Worksheet for Pressure Pipe

Project Description	
Project File	c:\fmw\tip.fm2
Worksheet	tip
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.00 lbs/in²
Pressure at 2	0.00 lbs/in²
Elevation at 1	0.50 ft
Elevation at 2	0.00 ft
Length	40.00 ft
C Coefficient	140.0
Diameter	10.00 in

Results		
Discharge	3.51	cfs
Headloss	0.50	ft
Energy Grade at 1	1.03	ft
Energy Grade at 2	0.53	ft
Hydraulic Grade at 1	0.50	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.62	ft
Velocity	6.44	ft/s
Velocity Head	0.65	ft
Friction Slope	0.012500	ft/ft

EAST

Worksheet
Worksheet for Pressure Pipe

Project Description	
Project File	c:\fmw\tip.fm2
Worksheet	tip
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.00 lbs/ft²
Pressure at 2	0.00 lbs/in²
Elevation at 1	2.50 ft
Elevation at 2	0.00 ft
Length	48.00 ft
C Coefficient	140.0
Diameter	10.00 in

Results		
Discharge	7.60	cfs
Headloss	2.50	ft
Energy Grade at 1	5.38	ft
Energy Grade at 2	2.88	ft
Hydraulic Grade at 1	2.50	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.62	ft
Velocity	13.93	ft/s
Velocity Head	3.01	ft
Friction Slope	0.052083	ft/ft

EAST

Worksheet
Worksheet for Pressure Pipe

Project Description	
Project File	c:\fmw\tip.fm2
Worksheet	tip
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.00 lbs/in²
Pressure at 2	0.00 lbs/in²
Elevation at 1	0.50 ft
Elevation at 2	0.00 ft
Length	48.00 ft
C Coefficient	140.0
Diameter	10.00 in

Results		
Discharge	3.19	cfs
Headloss	0.50	ft
Energy Grade at 1	6.87	ft
Energy Grade at 2	6.37	ft
Hydraulic Grade at 1	0.50	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.62	ft
Velocity	5.84	ft/s
Velocity Head	0.53	ft
Friction Slope	0.010417	ft/ft

EAST

Worksheet
Worksheet for Pressure Pipe

Project Description	
Project File	c:\fmw\tip.fm2
Worksheet	tip
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.00 lbs/in²
Pressure at 2	0.00 lbs/in²
Elevation at 1	5.00 ft
Elevation at 2	0.00 ft
Length	48.00 ft
C Coefficient	140.0
Diameter	10.00 in

Results		
Discharge	11.04	cfs
Headloss	5.00	ft
Energy Grade at 1	8.01	ft
Energy Grade at 2	3.01	ft
Hydraulic Grade at 1	5.00	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.62	ft
Velocity	20.25	ft/s
Velocity Head	6.37	ft
Friction Slope	0.104167	ft/ft

PROJECT FILE MEMO

Project: FAX! John R. 1 page
Date:
Subject:
By: ALB

JR: This is a bunch of numbers/calcs which you can pretty much ignore. Bottom Line on your outlet pipe: 16"

Assuming Clay Tiles

Proposed Outlet Diameter (in)	Peak Flow @ 2% Slope (cfs) Using Manning	Using Hazen-Williams
24	32	46
16	11	16
12	5	7
10	3	5
8	2	3

Average Slope	Peak Flow for Two 8" inlets (cfs)	
2%	4	5
4%	5	8
6%	6	9
8%	7	11
10%	8	12

F. New & Associates, Inc.
708 Roosevelt Road • P.O. Box 243 • Walkerton, Indiana 46574 • 219-586-3400

SUBSURFACE INVESTIGATION & GEOTECHNICAL RECOMMENDATIONS

PROPOSED DAMS AND PONDS

NORTH WEBSTER, INDIANA

A&W PROJECT NO: S8362

PREPARED BY:
ALT & WITZIG ENGINEERING, INC.
GEOTECHNICAL DIVISION

PREPARED FOR:
J. F. NEW AND ASSOCIATES, INC.
INDIANAPOLIS, INDIANA
NOVEMBER 17, 1998

Alt & Witzig Engineering, Inc.
3405 W. 96th Street • Indianapolis, Indiana 46268
(317) 875-7000 • Fax (317) 876-3705

November 17, 1998

J. F. New & Associates, Inc.
3955 Eagle Creek Parkway, Suite A
Indianapolis, Indiana 46254
ATTN: Ms. Gina Weilbaker

RE: Subsurface Investigation &
Geotechnical Recommendations
Proposed Dam
Lake Tippecanoe
North Webster, Indiana
Alt & Witzig File: S8362

Gentlemen:

In compliance with your request, we have conducted a subsurface investigation and geotechnical evaluation for the above referenced project. It is our pleasure to transmit four (4) copies of our report.

The results of our field test borings and laboratory tests are presented in the Appendix of this report. Our geotechnical recommendations for this project are presented in the Discussion and Recommendations section of this report.

If you have any questions or comments regarding these matters, please contact us at your convenience.

Very truly yours,

ALT & WITZIG ENGINEERING, INC.

Eric Felix,
Project Engineer

Thomas J. Coffey, P.E.

THOMAS J. COFFEY REGISTERED No. 19975 STATE OF INDIANA PROFESSIONAL ENGINEER

EF:TJC/kdc

TABLE OF CONTENTS

SUBSURFACE INVESTIGATION

AND

GEOTECHNICAL RECOMMENDATIONS

INTRODUCTION

General

This report presents the results of a subsurface investigation for two proposed lakes and dams to be constructed in North Webster, Indiana. This investigation was conducted for J. F. New & Associates, Inc., of Indianapolis, Indiana, the design engineers for this project.

Authorization to perform this investigation was in the form of a signed proposal between Ms. Gina Weilbaker of J. F. New & Associates, Inc. and Alt & Witzig Engineering, Inc.

The scope of this investigation included a review of geological maps of the area; a review of geological and related literature; a reconnaissance of the immediate site; a subsurface exploration; field and laboratory testing; and engineering analysis and evaluation of the subsurface materials.

The purpose of this subsurface investigation was to determine the various soils profile components and the engineering characteristics of the subsurface materials and to provide information regarding the construction of the proposed lake and dam.

DESCRIPTION OF SITE

Site Location

The project site is located in North Webster, Indiana. Specifically, the site of the new dams/lakes is located at the Lake Tippecanoe Country Club. In conjunction with this project, we drilled one (1) boring, B-7, just west of Webster Lake, within the White Property.

Site Topography, Drainage and Vegetation

The surface of the immediate site is gently rolling. Several surface drainage patterns have developed and drainage is primarily along the ground surface and into the existing lake. A majority of the proposed lake area was a wooded area.

The surrounding area is moderately developed with overhead and underground utilities, paved roads, and several mobile home structures.

General Geology

The site of this project lies in the Steuben Morainal Lake Area Regional Physiographic Unit of the State of Indiana. Anticipated soils are of mostly alluvium deposits consisting of silt, sand and gravel of recent age.

Bedrock in the project area lies in the Dekalb Lowland Bedrock Physiographic Unit of the State. Anticipated is black shale with gray shale and limestone of Devonian Age. Bedrock is expected to be more than two hundred (200) feet below the ground surface.

FIELD INVESTIGATIONS

Scope

Field investigations to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site, making borings located as shown on the plot plan, and performing standard penetration tests. The apparent groundwater level at each boring location was also measured.

Drilling and Sampling Procedures

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Representative samples were obtained employing split-spoon sampling procedures in accordance with ASTM Procedure D-1586.

Field Tests and Measurements

Penetration tests. During the sampling procedure, standard penetration tests were performed at regular intervals to obtain the standard penetration value of the soil. The standard penetration value is defined as the number of blows a 140-pound hammer, falling 30 inches, is required to advance the split-spoon sampler one (1) foot into the soil. The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Water level measurements. Water level observations were made during, upon completion and twenty-four (24) hours upon completion of boring operations and are noted on the boring logs. In relatively pervious soils such as sandy soils, the indicated elevations are considered reliable groundwater levels. In relatively impervious soils, the accurate determination of the groundwater elevation is not possible in even several days observation.

Ground surface elevations. Ground surface elevations were not made available at the time of the test borings. All depths and elevations referred to in this report are referenced from the existing ground surface.

LABORATORY INVESTIGATIONS

In addition to the field investigations, a supplemental laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the subsurface materials necessary in analyzing the behavior of the proposed dam.

All phases of the laboratory investigation were conducted in general accordance with applicable ASTM Specifications.

The laboratory testing program included supplementary visual classification and water content tests on several cohesive samples.

Samples of the cohesive soil from the split-spoon sampling device were frequently tested with a calibrated soil penetrometer which was used as an aid in determining the unconfined compressive strength of the soil. The values of the unconfined compressive strength as determined on soil samples from split-spoon sampling must be considered, recognizing the manner in which they were obtained since the split-spoon sampling techniques provide a representative but somewhat disturbed soil sample.

DISCUSSION AND RECOMMENDATIONS

Project Description

It is anticipated that two lakes and associated dams will be constructed at the Lake Tippecanoe Country Club. The dams will be approximately thirty (30) to forty (40) feet in length and approximately six (6) feet in height. Borrow is primarily to be taken from within the proposed lake area.

Lake Tippecanoe Country Club

Detention Ponds

Borings B-3 and B-5 were performed within the proposed Detention Pond 1 and borings B-4 and B-6 were performed for Detention Pond 2. The results of our field and laboratory tests indicate that the soils within the proposed pond areas are primarily silty clay with a trace of sand and gravel.

It is estimated that these soils should have permeabilities (k value) in the range of 10^{-6} to 10^{-7} cm/sec when compacted to 95% of maximum dry density.

Considering the above mentioned soil conditions and permeability characteristics, some shallow sandy soil layers should be anticipated during excavation. Thus, it is recommended to undercut the pond areas to an approximate depth of eighteen (18) inches. At this elevation, it will be necessary to disc and recompact the exposed subgrade for an additional depth of approximately six (6) to eight (8) inches and then backfill the undercut areas with the in-situ soils. It is recommended that a representative of the soils engineer be present at the site during this phase of the project to insure that proper compaction of the fill material is attained. Furthermore, if any sand seams and/or pockets are encountered, it will be necessary to construct a liner over any sand

pockets or layers to seal these permeable soils. Various types of liners are available for this purpose, including a clay-bentonite sealer, natural clay liners, and various synthetic liners. Natural clay liners are generally considered the most economical when suitable materials are available on-site. Topsoil and other highly organic materials, as well as the sands, are generally considered unsuitable for use as a liner material. Therefore, all topsoil and vegetation should be stripped from the lake area prior to placement of the proposed fill.

Proposed Dam

Borings B-1 and B-2 were performed for the dams for Pond 1 and Pond 2, respectively. Each boring was located relative to the centerline of the dam. Soils encountered within these borings were also predominately sandy silty clay and occasional sand seams to the termination depth of our borings.

Due to the apparent low permeability of the foundation materials encountered, it does not appear that a cutoff wall will be required at the proposed dam location. However, since the top three (3) feet of the existing soils have been subjected to frost action and surface runoff, a key trench should be provided to ensure cutoff to the deeper impervious materials. The key trench should be located at or upstream from the centerline of the proposed earth embankment. It should extend up the abutments as required and be deep enough to extend into a relatively impervious layer. The key trench should have a bottom width of a minimum of eight (8) feet and side slopes should not be steeper than 1:1.

CONSTRUCTION CONSIDERATIONS

Site Preparation

Excessively organic topsoil and loose dumped fill materials will generally undergo high volume changes which are detrimental to the behavior of structural fills placed upon them. Therefore, it is recommended that all loose materials be stripped from the construction areas and wasted or stockpiled for later use. Also, all trees and roots located within the plan of the proposed dam area should be removed. The organic materials should also be removed from all borrow areas prior to construction. The exact depth of stripping should be determined by a representative of the soils engineer in the field at the time of the stripping operations. Due to the soft consistency and the organic content of the shallow soils in the area of boring B-2, it is anticipated that some undercutting on the order of four (4) feet will be necessary. Furthermore, after the undercutting operations have been completed, it is recommended that the key trench be installed at this invert elevation prior to fill placement for the earth embankments.

Construction of Earth Embankment

The materials used in the filling operations should be suitable for compaction and must be free of vegetable matter, rubbish, large rock, wood, frozen material and other deleterious material. It appears that the soils within the lake area with the exception of the sand will be suitable for use as embankment fill materials given proper control during placement and compaction. It is recommended that the more pervious materials be placed at the outer slopes, and the silty clay soils be used for the impervious core of the dam.

The structural fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compaction. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicle be used as compacting equipment.

Material that is too wet to permit proper compaction may be stockpiled or be spread on the fill and permitted to dry, assisted by disking, harrowing, or pulverizing, if necessary, until the moisture content is reduced to a satisfactory value.

All fill should be compacted to 95 percent of the maximum dry density obtained in accordance with Standard Proctor ASTM D-698. Should the results of the in-place density tests indicate that the specified compaction limits are not obtained, the area represented by such tests should be re-worked and re-tested as required until the specified limits are reached. It is recommended that moisture content limits be within (-1) to (+2) of optimum moisture content during placement and compaction operations. It is recommended that a representative of the soils engineer be present at the site during the construction of the fill to insure that proper placement procedures are followed and to insure that adequate compaction of the fill material is attained.

Because of the high groundwater level, some difficulties during excavation and construction of the proposed embankment dam should be anticipated. However, depending upon the time of the year that the excavations are made, seepage from surface runoff may occur into excavations. Since soils tend to loosen when exposed to free water, every effort should be made to keep excavations dry. A gravity drainage system, sump pumps, or other conventional dewatering procedures should be sufficient for this purpose.

DESIGN PRINCIPLES AND CONSIDERATIONS

Slope Stability

The earth embankment for this project must be stable under the most critical loading conditions which might occur during construction or operation.

It is recommended that all cohesive soils placed in the earth fill dam be compacted to a minimum 95 percent of maximum dry density in accordance with ASTM D-698. Based upon the laboratory strength tests and experience with soils on similar earth fill dams, an upstream slope of 3:1 (H:V) and a downstream slope of 3:1 (H:V) is recommended, as per standard engineering practices.

Settlement

The foundation material for this earth dam must be able to resist the applied pressure due to the embankment. The settlement that occurs must not be detrimental to the earth fill dam. The soil borings indicate that the compressibility of the shallow soils at the dam site is medium based on visual inspection, penetrometer resistance, unconfined compressive strength tests, moisture content tests, and standard penetration test results. Thus, undercutting on the order of four (4) feet should be anticipated at the eastern dam location.

With time the earth dam will consolidate, but these settlements will be minimal if the dam is constructed according to the guidelines given in other portions of this report. It is estimated that the total settlement of the crest of the dam will be within tolerable limits.

The significance of proper foundation preparation such as proofrolling of the subgrade and the removal of soft soils and backfilling with compacted structural fill can not be over-emphasized.

Seepage Control - Embankment

Seepage will take place through the earth embankment. Providing a means for reducing the quantity of flow to an allowable value and controlling the location and magnitude of seepage forces are important design considerations.

Even though the earth structure to be constructed on this project is considered to be a homogeneous embankment, there is likely to be some variation in the nature of borrow materials. It is important that the coarser and more pervious of the materials available be placed at the outer slopes, as shown in your design plans, in order to approach as nearly as possible the advantages of a zoned embankment.

A recommended method of controlling the discharge of seepage and minimizing the possibility of piping failure is to use a horizontal drainage blanket. The drainage blanket shall meet filter and permeability criteria and should extend from the downstream slope of the dam to well within the body of the embankment. Because filters are expensive to construct, a minimum length filter is desirable. For this project, it is recommended that the filter drain begin at the downstream toe of the embankment and extend upstream to within a distance equal to the height of the dam plus five (5) feet from the centerline of the dam. The drainage blanket should be carried across the valley floor and up the abutments to an elevation corresponding to the highest level at which water will be stored in the reservoir for an appreciable time. The drainage blanket should be a minimum of two (2) feet thick and be constructed of properly graded granular material approved by the soils engineer.

A toe drain should be provided within the horizontal drainage blanket to control seepage. The toe drain should consist of an appropriate size slotted drain or perforated pipe no less than four (4) inches in diameter and should be encapsulated with a geotextile filter fabric that will not permit

the passage of fine soils and should not impede flow from the drainage blanket. The pipe shall be such that seepage from within the horizontal drainage blanket will be collected over the lifetime of the earthen structure and controlled downstream without impeding the performance of the embankment dam. Sufficient grading of blanket and toe drain granular materials shall be provided in order that an appreciable amount of fines are not lost, thus, resulting in failure of the embankment dam. Again, a representative of the soils engineer should be retained during construction to ascertain filter criteria, etc. is within acceptable limits.

Upstream Slope Protection

Adequate slope protection must be provided for the earth embankment against wind and wave erosion, weathering, and ice damage. The type of protection provided will be governed by the available materials and the economic applicability. Dumped riprap is the most preferred type of upstream slope protection and should be placed on the upstream face of the slope from approximately five (5) feet below normal low pool level to the crest of the embankment. The nominal thickness of dumped riprap for the upstream slope should be eighteen (18) inches. A geotextile filter fabric should be provided immediately beneath the riprap. Such a blanket is necessary to prevent the fine grained materials of the embankment slopes from being washed out through the voids in the riprap.

Downstream Slope Protection

The downstream slope of this homogeneous embankment may be protected against erosion by wind and rainfall runoff by sodding or seeding. Temporary erosion control may be necessary until growth and root systems are established. If rock is preferred, an eight (8) inch thick layer should provide sufficient protection.

SUMMARY

An exploration and evaluation of the subsurface conditions has been conducted at the site of the proposed Lake Tippecanoe Country Club Dams in North Webster, Indiana.

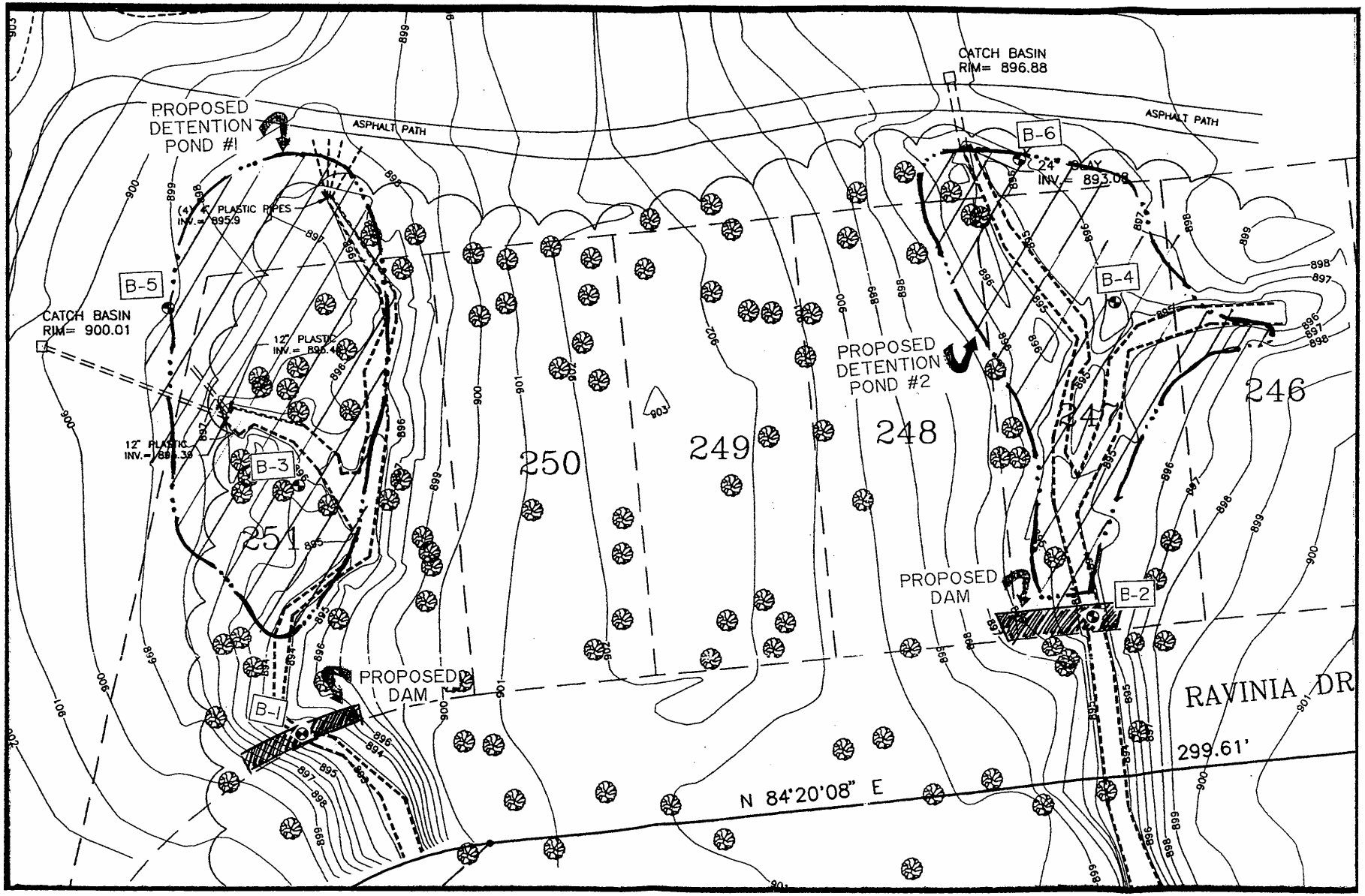
The recommendations submitted are based on the available soil information and the preliminary design details furnished by the engineers for the proposed dam. Any revision in the plans for the proposed structure from those enumerated in this report should be brought to the attention of the soils engineer so that he may determine if changes in the recommendations are required.

APPENDIX

RECOMMENDED SPECIFICATIONS FOR COMPACTED FILLS AND BACKFILLS

All fill shall be formed from material free of vegetable matter, rubbish, large rock, and other deleterious material. Prior to placement of fill, a sample of the proposed fill material should be submitted to the soils engineer for his approval. The fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compactions. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicles be used as compacting equipment. Material containing an excess of water so the specified compaction limits can not be attained should be spread and dried to a moisture content which will permit proper compaction. All fill should be compacted to the specified percent of the maximum density obtained in accordance with ASTM density Test D-698 (95 percent of maximum dry density below). It is recommended that the materials be compacted slightly (<2%) wetter than the optimum moisture content. Should the results of the in-place density tests indicate that the specified compaction limits are not obtained, the areas represented by such tests should be reworked and retested as required until the specified limits are reached.

BORING
LOCATION
PLAN



North
Scale: 1"=30'

PREPARED FOR: J.F. New and Assoc., Inc. Indianapolis, Indiana Proposed Dams and Ponds North Webster, Indiana	A&W	PREPARED BY: Alt & Witzig Engineering, Inc. Indianapolis, Indiana S8362 11/98

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - Lake Tippecanoe Country Club
LOCATION Kosciusko County, Indiana

Boring # B-1
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

At Completion Dry ft.
After hours ft.
Water on Rods Dry ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Brown Clayey Silt with a trace of Organics (Topsoil)	1	0.5									
	Brown Sandy Clayey Silt with a trace of Gravel	5		1	SS			50/3			9.3	
			6.0	2	SS			40		4.5+	7.7	
	Brown to Gray Mottled Sandy Silty Clay			3	SS			25	3.7	4.0	10.7	
		10	9.0	4	SS			32	5.9	4.5+		
	Gray Sandy Silty Clay with Gravel	15		5	SS			16	4.1	4.0	10.2	
		20		6	SS			17	3.5	2.8	10.0	
		25	26.0	7	SS			20	4.3	3.3	9.5	
	Boring Terminated 26.0 feet											

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - Lake Tippecanoe Country Club
LOCATION Kosciusko County, Indiana

Boring # B-2
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

At Completion 2.0 ft.
After hours ft.
Water on Rods 8.0 ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Brown Clayey Silt with a trace of Organics (Topsoil)	1	1.0									
	Brown Silty Clay with a trace of Organics		4.0	1	SS			5			46.5	
	Gray Sandy Clay with a trace of Gravel	5		2	SS			4		0.5	17.5	
	Gray Sandy Silty Clay		7.5 8.5	3	SS			6	1.6	2.0	11.3	
	Gray Sandy Silty Clay with a trace of Gravel and Wet Sand Seams	10		4	SS			7	1.6	1.3	12.4	
		15		5	SS			18		3.3	10.8	
		20		6	SS			28				
	Boring terminated at 21.0 feet		21.0									

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - Lake Tippecanoe Country Club
LOCATION Kosciusko County, Indiana

Boring # B-3
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

At Completion P-1.5 ft.
After hours ft.
Water on Rods Dry ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Gray Silty Clay with Organics	1		1	SS		▽	5		1.0	33.1	
		5	5.0	2	SS			11			10.8	
	Brown to Gray Sandy Silty Clay			3	SS			12			10.6	
		10	10.0	4	SS			14		1.5	10.8	
	Gray Silty Sandy Clay with Gravel	15										
			16.0	5	SS			18	3.5	3.0	11.2	
	Boring terminated at 16.0 feet											

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - Lake Tippecanoe Country Club
LOCATION Kosciusko County, Indiana

Boring # B-4
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

▽ At Completion 2.0 ft.
▼ After hours ft.
○ Water on Rods 8.0 ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Brown Clayey Silt with a trace of Organics (Topsoil)	1	1.0				▽					
	Brown Clayey Silt		3.0	1	SS	X		5			29.1	
	Brown Sandy Clayey Silt	5		2	SS	X		9		2.0	27.8	
			7.0	3	SS	X	○	10				
	Gray Clayey Silt with a trace of Sand and Gravel with Wet Sand Seams	10		4	SS	X		13				
		15	16.0	5	SS	X		12		3.0	10.2	
	Boring terminated at 16.0 feet											

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - Lake Tippecanoe Country Club
LOCATION Kosciusko County, Indiana

Boring # B-5
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

At Completion P-1.0 ft.
After hours ft.
Water on Rods Dry ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Brown Clayey Silt with a trace of Organics (Topsoil)	1	0.7				▽					
	Brown to Gray Silty Clay with a trace of Sand	5		1	SS	X		13		2.5		
				2	SS	X		7				
	Brown Silty Clay with Sand and Gravel		6.5	3	SS	X		13				
			9.0									
	Gray Sandy Silty Clay with Gravel	10		4	SS	X		10	1.6	1.5		
		15										
			16.0	5	SS	X		11	1.9	1.5		
	Boring terminated at 16.0 feet											

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - Lake Tippecanoe Country Club
LOCATION Kosciusko County, Indiana

Boring # B-6
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

▽ At Completion 2.0 ft.
▼ After hours ft.
○ Water on Rods Dry ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Brown Clayey Silt with a trace of Organics (Topsoil)	1					▽					
	Gray Silty Clay		4.0	1	SS			4		1.0	18.1	
	Brown Gray Mottled Sandy Silty Clay	5		2	SS			12		1.0	12.6	
				3	SS			9			12.5	
			9.0									
	Gray Sandy Silty Clay with Gravel	10		4	SS			11		1.0	13.3	
		15	16.0	5	SS			19		4.5	9.8	
	Boring terminated at 16.0 feet											

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT J.F. New & Associates, Inc.
PROJECT NAME Proposed Dam - White Property Boring
LOCATION Kosciusko County, Indiana

Boring # B-7
Alt & Witzig File No. S8362

DRILLING and SAMPLING INFORMATION

Date Started 09/27/98
Date Completed 09/27/98
Boring Method HSA
Hammer Wt. 140 lbs.
Hammer Drop 30 in.
Spoon Sampler OD 2 in.

GROUNDWATER

At Completion 1.5 ft.
After hours ft.
Water on Rods 10.0 ft.

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Depth Scale	Strata Depth	Sample No.	Sample Type	Sampler Graphics	Ground Water	Standard Penetration Test, N Blows/foot	Qu - tsf Unconfined Compressive Strength	Pp - tsf Pocket Penetrometer	Moisture Content %	Remarks
	Brown Clayey Silt with a trace of Organics	1					▽					
			4.0	1	SS			4				
	Gray Wet Medium Sand and Gravel	5		2	SS			14				
				3	SS			15				
		10		4	SS		○	20				
		15	16.0	5	SS			26				
	Boring terminated at 16.0 feet											

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Auger
DC - Driving Casing
MD - Mud Drilling

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soils unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140-pound hammer falling 30 inches on a 2 inch O.D. split-spoon

Qu: Unconfined Compressive Strength, TSF

Qp: Penetrometer value, unconfined compressive strength, TSF

Mc: Water content, %

LL: Liquid Limit, %

Pl: Plastic Limit, %

Dd: Natural Dry Density, PCF

 : Apparent groundwater level at time noted after completion

DRILLING AND SAMPLING SYMBOLS

SS: Split-spoon - 1 3/8" I.D., 2" O.D., except where noted
ST: Shelby-tube - 3" O.D., except where noted
AU: Auger sample
DB: Diamond bit
CB: Carbide bit
WS: Washed Sample

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

TERM (NON-COHESIVE SOILS)	BLOWS PER FOOT
Very loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very dense	Over 50

TERM (COHESIVE SOILS)	Qu (TSF)
Very soft	0 - 0.25
Soft	0.25 - 0.50
Medium	0.50 - 1.00
Stiff	1.00 - 2.00
Very stiff	2.00 - 4.00
Hard	4.00 +

PARTICLE SIZE

Boulders 8 in. + Coarse Sand 5mm-0.6mm Silt 0.74mm-0.005mm
Cobbles 8 in.-3in. Medium Sand 0.6mm-0.2mm Clay -0.005mm
Gravel 3 in.-5mm Fine Sand 0.2mm-0.74mm